THE 15TH INTERNATIONAL CONFERENCE ON CRYSTAL GROWTH
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and
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will be held
AUGUST 12 - 17, 2007, SALT LAKE CITY, UTAH

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Title:

New growth strategies to enhance IR and visible emissions in crystals of the $KTiOPO_4$ family doped with lanthanide ions.

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Abstract:

The very recent laser operation in the near-IR achieved in $RbTiOPO_4$ crystals codoped with Yb^{3+} and Nb^{5+} has propelled the interest in self-frequency doubling crystals based on this family of materials.

We present three new growth strategies from high-temperature solution methods to obtain single crystals showing an enhanced lanthanide emission. They are based in an increase of concentration of lanthanide ion in the crystalline matrix, and in energy transfer mechanisms among lanthanide ions.

Growth of $RbTiOPO_4$ single crystals codoped with Ln^{3+} (Ln = Er or Yb) and Nb^{5+} in solutions containing WO_3 has been revealed as a good method to further increase the lanthanide concentration in the crystalline matrix. The increase in lanthanide concentration in these crystals enhances the intensity of the near IR emissions at around 1 mm (in the case of Yb^{3+}) and 1.5 mm (in the case of Er^{3+}). Furthermore, as the viscosity of the solution is significantly reduced, crystal can be grown with sizes up to 5 ´ 5 ´ 5 mm in a ´ b ´ c directions by the Top-Seeded Solution Growth technique in only one week. This represents an increase in the crystal growth rate of a factor up to four when compared with crystals growth in self-fluxes.

Codoping $RbTiOPO_4$ single crystals with Yb^{3+} and Ta^{5+}, allow to get Yb concentrations of the order of that obtained in $RbTiOPO_4$ crystals codoped with Yb^{3+} and Nb^{5+}. However, the concentration of Ta_2O_5 in the solution of growth required to get this Yb concentration is lower than that required of Nb_2O_5 when growing Yb:Nb:$RbTiOPO_4$ single crystals, which minimizes growth problems related with the presence of these ions in the solution.

Finally, the introduction of small quantities of Er^{3+} in Yb:Nb:$RbTiOPO_4$ crystals, allow to enhance the near-IR emission at 1.5 mm coming from Er^{3+}. And most important, the visible emissions (green and red) of Er^{3+}, that in Er:Nb:$RbTiOPO_4$ single crystals could only be seen when pumping at shorter wavelengths than the emissions to be observed, in Er-containing Yb:Nb:$RbTiOPO_4$ single crystals, these emissions could be observed when pumping Yb^{3+} at 904 nm, by energy transfer mechanisms between Yb^{3+} and Er^{3+}, and by up-conversion effects in this last ion. This is the first time that up-conversion phenomena have been observed in crystals of the $KTiOPO_4$ family containing Er^{3+}.

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